

J.F.Klotzsch: His Scottish Legacy

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ABSTRACT

Fungal specimens collected by the German botanist J.F. Klotzsch and found amongst the herbarium collections in Edinburgh are documented. Their importance in an understanding of the early development of British mycology is emphasised and their connections with luminaries of the period demonstrated. Historical notes on wider issues from this material are presented. Some re-determinations have been necessary but the reasons for so doing are explained. Although the majority of the records are of common fungi there are 16 which are of greater significance. Even these common fungi indicate the mycodiversity found in the western part of the central belt of Scotland in the 1830s.

INTRODUCTION

A revision of the basidiomycetous fungi in J. Stevenson's *Mycologia Scotica* (1879), which is posted on the web-site <http://sites.google.com/site/scottishfungi>, is heavily based on the specimens housed in the mycological herbarium at the Royal Botanic Garden, Edinburgh (E). Amongst the collections were several connected with the history of the Botanic Gardens and Department of Botany, University of Glasgow. The connection between these two was not one of ownership but through the patronage of the Professor in Glasgow at the time. In the re-organization of the Edinburgh herbarium in 1963-4 it became clear that deposited there was material from Johan Friederich Klotzsch, amassed whilst he was in Glasgow during his tenure-ship as mycologist at £50 per year (Allen, 1967) to William Jackson Hooker (Watling, 1986). Because of the way the specimens were arranged on the herbarium sheets it was only later appreciated how much material actually existed in Edinburgh.

Setting the scene: historical perspective.

How the Klotzsch collections originally came to Edinburgh is not recorded but they may have been gifted to Robert Kaye Greville by his friend and close associate W.J. Hooker, e.g. they travelled and collected together whilst crossing from the West Coast of Scotland to Inverness, finding for instance

at Loch Sheil *Peziza cribrosa* Grev.¹ There is some evidence of this as one collection of *Boletus grevillei* (= *Suillus*) in E is actually designated 'Herb. Greville' (Watling 1960). The vascular plant material of Greville went to Glasgow University, his algae have been located in the Natural History Museum, London and some cryptogams, including his fungi, went to Kew (Ainsworth, 1976; Reid & Austwick, 1969). The rest of Greville's cryptogams, very probably including the specimens under scrutiny here, were obtained by J. Hutton Balfour, then Regius Keeper in Edinburgh and along with the Klotzsch material incorporated into the collection of specimens and manuscripts in Edinburgh. Thus they became part of the herbarium at the Royal Botanic Garden in Edinburgh. The collections made by Klotzsch were not known to F. A. Stafleu & M.S. Cowan (1979), when compiling their entry for Klotzsch for their *magnus opus*. The material was certainly in Edinburgh at the time of the production of Stevenson's *Mycologia Scotica* (1879) as reference is made to the specimens. Judging from the material available and comparing it with the specimens in Kew (Reid & Austwick, 1963) the Edinburgh material is probably composed of duplicates of the more plentiful species with many of the rarer species, and perhaps less bountiful material, not to be found in Edinburgh. Field notes accompanying the specimens are generally lacking in the Edinburgh collections.

Whilst in the process of writing his revision of Sowerby & Smith's *English Flora* (1790) as the *British Flora*, Hooker (1832), then Professor of Botany at Glasgow, was amply qualified to tackle the chlorophyllous components of the flora he felt not so capable for the non-lichenized fungi. He had to rely on *Flora Glottiana* (Hopkirk, 1813), covering the indigenous plants of the Clyde valley and one of the first local catalogues in the British Isles to include fungi. Thomas Hopkirk was a Glasgow businessman and befriended Hooker on his arrival in Glasgow when Robert Graham left for the Chair of

¹ Collections of this fungus as 'Klotzsch in Hooker herb.' have been shown to be *Peziza badia* Pers.: Mérat. A collection of *Aleuria aurantia* (Pers.) Fuckel in E was collected on the same trip.

Botany in Edinburgh. As a graduate of Glasgow University, Hopkirk continued to take an interest in the institute being instrumental in part in founding the Botanical Garden there. In Hooker's Part 2 of *British Flora* (1833) the arrangement adopted for the fungi was that of the *Synopsis Methodica Fungorum* (Persoon, 1801) but really he added little more than could be gleaned from Hopkirk and the publications of J. Lightfoot (1777) and J. Dickson (1787). Although Hooker had already amassed a collection of fungi (*q.v.* Footnote 1 above), these organisms apparently defeated him so Johan Frederick Klotzsch was called upon to overcome this gap in knowledge (Allen, 1967), which this young man did admirably during his two years in Glasgow.

Klotzsch was born in Wittenburg on 9 June 1805 and studied botany and pharmacy under Prof. J. H. F. Link in Berlin. Apparently he was quite a dapper dresser according to reports (Allen, 1967) and commenced work in Glasgow in 1830 immediately setting about putting the fungal herbarium into some order. In addition he expanded the range of specimens therein by collecting extensively in Scotland, especially in the west. He resided in Scotland for two years and when Hooker left to take up his position as Director of the Royal Botanic Gardens, Kew Klotzsch's material was taken with him. It was customary in those days that the books and herbarium specimens accumulated during the tenure of professorship were in fact the professor's property and in the case of Hooker this tradition was exercised. Indeed to confirm the specimens were Hooker's in Stevenson (1879) many of Klotzsch's records appear as 'Hooker Herbariorum', something also found in Berkeley's publication in 1836. It was later in 1865 that the British Government purchased Hooker's material, the fungal specimens then forming the basis of the present fungarium at Kew (Ramsbottom, 1963, Ainsworth, 1976 & 1996). These extensive collections with accompanying manuscript notes allowed the Rev. Miles J. Berkeley, the 'Father of British Mycology', to complete studies for his census of British fungi, an undertaking he was encouraged to do by both Hooker and Greville. The records appear in both Sowerby & James E. Smith's *English Botany* Vol. 5 and later as part of Hooker's *British Flora* vol 2. Thus Klotzsch's activities in the two years he spent in Glasgow played a decisive role in the development of mycology in Scotland and indeed in the British Isles.

After Glasgow

At the end of Klotzsch's stay in Glasgow, he returned to Berlin where he took a medical degree. Once home he soon published an account of some of James Sowerby's fungi, including material in the Linnean Society of London (Klotzsch, 1832), where he proposed several re-determinations. One of the fungi attributed to Sowerby was *Agaricus spinipes*

Sow. and was correctly amended by Klotzsch to *Agaricus (Collybia) esculentus*, later placed in *Pseudohiatula* but presently known as *Strobilurus esculentus* (Wulfen) Singer. Klotzsch must have examined these specimens whilst resident in Glasgow and it is likely that before he returned home he had also examined polypore material from Mauritius, India etc., probably also material in the hands of Hooker. The results of these studies appeared in print soon after he returned to Germany (Klotzsch, 1833a) and included several new species, e.g. the insectivorous *Sphaeria sphecocephala* = *Ophiocordyceps sphecocephala* (Klotzsch ex Berk.) Sung *et al.* Klotzsch appeared not to be idle even whilst studying for his medical degree for as soon as returning to Germany he continued his researches and expanded his interests by publishing on various vascular plant genera. He ultimately became Curator of the Royal Herbarium in Berlin. In his lifetime he produced a whole series of compilations and fungal *exsiccata* (Kohlmeyer, 1962; Stevenson, 1967 & 1971), which were a natural continuation of Fries' *Fungi Scleromyceti*.² Rabenhorst continued Klotzsch's project after the first 2 Centuries and renamed the 3rd edition *Fungi Europaei exs. Klotzschii herbarii mycologici continuato* (Rabenhorst 1855; 1859; 1860). This

² Pertinent to this study is a collection of material from the 19th century housed in University of Glasgow as *Fungi Scleromyceti*. These specimens were drawn together by Elias Fries who became extremely influential in the development of mycological systematics and became known as the undisputed 'Father of Mycology'. Hutchinson (1964) described the Glasgow holdings of this rather important *exsiccata*; in contrast there are very few specimens in E, which can be attributed to Fries. The Glasgow specimens have been assembled in fascicles of dried specimens covering many of the familiar small, black, speck-like fungi and their relatives found on twigs and herbaceous stems, termed pyrenomycetes, although there were other items included. This is a most important collection as it demonstrates the concept which pervaded the 19th, and even into 20th Century. The collection was probably acquired by Glasgow as part of the herbarium of Hooker, who corresponded directly with Fries; these collections, if that is the case, apparently did not go to Kew when Hooker left for London. This copy of *Fungi Scleromyceti* is now in the University library having been transferred there from the Botany Dept., luckily before a major fire there on 24 October 2001. There is little doubt that Klotzsch would have had access to this *exsiccata* and apparently manuscript notes, although he only occasionally collected micro-fungi³, concentrating as he did on the basidiomycetous macromycetes. Holm & Nannfeldt (1963) have discussed at length Fries' *Fungi Scleromyceti*.

³ Material in Fleming's herbarium contains micro-fungi collected by Klotzsch such as *Sphaeria (Depezea) unedinicola* on the leaves of *Arbutus unedo* in the Glasgow Botanic Gardens. Greville in Edinburgh at this time was specializing in the micro-fungi, especially the basidiomycetous forms – the rust- and smut fungi. There are several micro-fungi in the Kew collections from Klotzsch (pers. comm., Begona Aguire-Hudson, 2014).

became the forerunner of Rabenhorst's important compilation on which the mycological part of the *Kryptogamenflora-Flora von Deutschland, Oesterreich und der Schweiz* was based and which appeared ten years later compiled in collaboration with such great mycological luminaries as A de Bary, H. Rehm and G. Winter to name a few (Bessey, 1950). This new edition ran to eight centuries. Klotzsch's *exsiccata* only covered German material but Rabenhorst's continuation, although originally covering European species of fungi it soon started to include extra-European collections (Stevenson, 1971). Klotzsch had published a further series of papers notably on polyporaceous fungi commenting on taxa, including species from Britain (Klotzsch, 1833b & c, 1835, 1838). Ryvar den (1976) has re-examined the bracket fungi deposited in E, many of which are of tropical origin; sadly many are in bad condition. There is only one type *viz*, *Polyporus aranarius*, (Klotzsch, 1833b) in Edinburgh, described from the Orient. According to Ryvar den (1976) it is probably *Antrodia albida* (Fr.) Donk, although it is badly developed. This species is uncommon although widespread on branches of *Salix*, *Fagus* and *Corylus* in Scotland. It is commoner in England where it is found on an even wider range of hosts.

Pegler (1983) carried out a similar study on Klotzsch's specimens assigned to *Lentinus*. In the herbarium of the Royal Botanic Garden, Edinburgh there is a collection of Klotzsch's new genus, *Leolophia* (1836), based on *L. vulpina* from India; this same species appears under *L. alopecia* Fr. in Fries (1836), later becoming *Lentinus alopecinus* Fr. (1838). It is now thought to be the same as *Lentinus ciliatus* Lév. Unfortunately several of Klotzsch's holotypes have not been located; the German specimens may well have been lost during the hostilities of World War II as it is known that many specimens in Berlin were destroyed through allied action (Stafleu & Cowan, 1979).

Klotzsch died in November 1860 in Berlin after an extremely successful and prestigious career as a botanist and mycologist. Less well known are his illustrations of fungal cystidia, basidia and basidiospores of no less than 25 different species of basidiomycete executed for him by P. Phoebus of Giessen (Klotzsch 1838a & b). The first volume became one of the first important contributions for dismissing the idea that mushrooms had asci, an idea adhered to by no less than his Scottish mentor Greville. He also discussed in the same three volumes the possible function of cystidia.

As indicated there are good holdings of Klotzsch material in the Royal Botanic Gardens, Kew, including the type of *Agaricus hookeri*, named in his employer's honour and collected in Glasgow; no specimens are apparently in Edinburgh. On examination the collection agrees in all ways with

what is currently known as *Melanophyllum haemospermum* (Bull.) Kriesel, an agaric perhaps best known as *M. echinatum* (Roth) Singer to forayers. It is a member of the Agaricaceae, and is infrequent but widespread in Scotland. Although often occurring in troops this species is probably under-recorded because of its rather dull brown colours and preference for growing in hedgerows or concealed by vegetation and trash. The type of *Agaricus mariae*, named after Klotzsch's then employer's daughter, Maria, who had found the fungus, is in the herbarium of the Royal Botanic Gardens, Kew but no corresponding collection is in Edinburgh. It was found in a conservatory in the Glasgow Botanic Gardens at Sandyford and illustrated for Klotzsch (1832). It turns out to be the same as *Lepiota aspera* (Pers.) Quél., or *L. friesii* (Lasch) Quél., if the latter is considered a distinct species; see Reid & Austwick (1963). *L. aspera* is infrequent in Scotland but none-the-less widespread being found in hedgerows and at the margins of woodland, especially on disturbed soils. It is considered rather common elsewhere in the British Isles, especially in the south on more calcareous soils. Similarly from the glasshouses at Sandyford came specimens of the false truffle, *Hymenangium album* Klotzsch of which there is type material in E. However, probably one of the most important collections in the Royal Botanic Garden, Edinburgh, with parallel parts in Kew Gardens is that composed of specimens of the extremely common *Boletus grevillei* (Klotzsch, 1832), named after Klotzsch's acquaintance, the Edinburgh mycologist R.K. Greville.

This appears to be the correct name for what was previously called *Suillus elegans* (Schum.) Snell. There are other proposed new species in E but which were never published, *e.g.* *Agaricus tabularis* based on specimens from the Botanic Garden in Glasgow and *Agaricus montosus*. The last was said to come from the highest mountains in Scotland. Also reported as being in K and sadly not duplicated in E is a collection of the very rare *Climacocystis borealis* (Fr.) Kotl. & Pouzar (as *Polyporus borealis*). The collection is correctly identified according to Reid & Austwick (1963) but there is no indication as to the locality of the find.⁴

⁴ Since Klotzsch's material was preserved, this species has been recorded in Stevenson (1879) from Aberdeenshire (from Balnamoon by Rev. Anderson) and Perthshire (from Strachan by J. Sims). Sadly no voucher material exists to support these records nor are they available for a more recent 1980 collection from Perthshire. Stevenson usually refers to localities and collectors when dealing with rare fungi so it is a mystery why he omits the Klotzsch record of *Poly.borealis* even in his *British Hymenomycetes* (1886), so did Stevenson know the collection was of non-British origin? Equal confusion exists for more recent British records for no voucher material supports the records from Gloucestershire as late as 1999 and Shropshire in 1995 (Legon & Henrici,

Enter Rev. Fleming

Fortuitously during the preparation of his account of mycology in Scotland (Watling, 1986) the author was very privileged to be able to examine and comment on an old collection of fungi parcelled in a brown packet, then held in the Kelvingrove Museum, Glasgow and labelled 'Fungi Fleming'. The Rev. J. Fleming had amassed a considerable collection of vascular plants during his life, which are now found in the herbaria in the Glasgow Resources collection, formerly the Kelvingrove Museum in Glasgow (GLAM), in addition to E. Footnote 5. The fungal collections were donated independently in 1902 by Major J.A. Fleming (Walker, pers. comm.). The collection is of great significance as it consists mainly of Klotzsch material and throws light onto more of the movements of Klotzsch during 1831 than indicated by the material in K or E⁵. The collection reveals a further clutch of proposed new species which along with the other material have been the subject of a separate publication (Watling 2014). Some specimens are duplicates of those in E (or is it vice versa?). All these collections were also unknown to Stafleu & Cowan (1979) and to Kohlmeyer (1962).

METHODS AND MATERIALS

The methods of examination of the herbarium specimens noted in this paper follow those outlined in Henderson, Orton & Watling (1969). Klotzsch's specimens are mounted in the traditional way for the period, *i.e.* flattened sections or halved fruiting bodies tightly glued to a sheet in a similar way as to how vascular plants were then mounted. Today fungal specimens for incorporation into the

2005). Apparently other material in K under this name is all misidentified or of foreign origin. Many of Klotzsch's collections are neither localized nor dated, or both, so *C. borealis* might be considered in the same category and therefore possibly of British origin. Through the kind efforts of Begona Aguirre-Hudson in the Kew Herbarium the material has been located and the labels and writing on the label are not in the same form as in his Edinburgh or Fleming specimens. The specimens have been annotated at a later date as 'possibly from Germany' and this may be the case with Klotzsch's return there after completing his commission for Hooker and his connections with J.H.F. Link. We will never know for certain whether the specimen was from Scotland. Certainly the Kew label matches Klotzsch labels in E from Germany and is different to his Glasgow ones.

⁵ Fleming in the text below refers to the Rev. John Fleming who spent the first part of his career in the church but later entered academia. He became Professor of Natural Philosophy in Aberdeen in 1834. Ten years later saw him as Professor of Natural Sciences in the Free Church College in Edinburgh and President of the Botanical Society of Edinburgh over the period 1847-50. It may be through these later connections that Fleming came by this important Klotzsch fungal collection, which was evidently kept separate from his vascular plant specimens; see Jones, 1980.

herbarium are kept as a whole, unless extremely large, and then packaged or boxed. The standard of preservation in most of the collections is quite good considering their age, although some specimens sometime in the past have been grazed by mites; only a few collections are unable to furnish the necessary distinguishing microscopic characters as the specimens are too badly damaged. Only a few collections involve whole specimens and then these are of the smaller taxa; collections are usually accompanied by locality data but descriptive notes, except sometimes substrate information is absent. All labels are in Latin and in the same distinctive script with a German flourish to many letters sometimes making it difficult to decipher. Some labels even those accompanying a collection written in flamboyant script appear in the same hand but are much better, written and stronger in form and clearly legible suggesting that perhaps these collections were destined for someone else.

In some cases where there is more than one collection in a packet descriptive data, even for localities is only found in one of the collections. In most cases the locality and habitat details are very general and appear to reflect Klotzsch's personal observations. The label often only reads 'September to October'. Klotzsch had a limited number of texts to assist him in his identification, the main source of his information being Fries' *Systema Mycologicum* (1821) to which a page reference to the species was often added to the label. On some labels there are several references to other, even earlier books, one of which was certainly in the hands of Klotzsch, *viz.* *Coloured Figures of English Fungi* (Sowerby, 1797-1809), a text he apparently then referred to when he found differences between his collections and Fries' 1821 account and was more in keeping with Sowerby. He usually then gives the Plate number on the label. It is obvious that the specimens were curated sometime whilst in the care of E as Klotzsch's original labels have been cut from their place of origin and placed in the then currently used herbarium capsules. These specimens mounted on their original paper have been cut out around the specimen and sometimes an additional label accompanies them. This is obvious in the case of *Agaricus (Hygrophorus) camarophyllus* Alb. & Schwein. from Garscube where the label on the inside of the capsule fits neatly into the area cut from the mount. In some of the other collections, *e.g.* *Amanita fulva* (Schaeff.) Fr., there are two collections in the same capsule with the label mounted below each specimen; similarities are found for *Coprinus comatus* (O.F.Müll.) Pers. found at Castle Semple. This may indicate the probable way this process was carried out during later curation. Some specimens have been mounted on herbarium sheets and apparently a re-determination indicated to bring the specimen up-to-date to the names known in the mid-20th century. The labelling was possibly by William

Edgar Evans judging from the script, a former curator in the Herbarium (Hedge & Lamond, 1963). Some records, which appear in Stevenson (1879), are supported by only watershed information or the briefest information on locality and sadly these cannot be expanded from examination of the actual specimens. Thus the little known telamonatoid webcap *Cortinarius bulbosus* Sow., as *Agaricus bulbosus* Sow., is recorded as 'Klotzsch in Hook. Herb. Glasgow'. It is poorly understood in the British Isles and is only substantiated according to Legon & Henrici (1990) by a single collection from England; it is not mentioned in Reid & Austwick (1963). It is strongly possible that for some material consisting of multiple specimens in keeping with other mycologists, such as Rabenhorst, M.C.Cooke and perhaps naturalists in other disciplines, for common so-called well-known species, that *exsiccata* are made up from more than one source. A good example from Klotzsch is undoubtedly his material of *Laccaria laccata* (Scop.) Cooke.

COLLECTING LOCALITIES

Glasgow was the academic centre of west Scotland with the university founded in 1471. Klotzsch was therefore at a centre of excellence and used the city as a base from which to collect in the north-west of the centre of the city, Dougalston, near Milngarvie, west of Maryhill at Garscube, Blantyre in the Upper Clyde and around Paisley extending his trips to Castle Semple and south to Pinmore and Girvan, and Carmel and Kingswell in Ayrshire. The Glasgow Botanic Garden situated at Sandyford was a particularly convenient place in which to collect with the additional feature of an extensive development of glasshouses, planted with tender, often exotic vascular plants. These were a source of potentially unusual taxa. It was common for Klotzsch to set out by 4am to go collecting and was often considered by the local people which he met an amusing yet intimidating sight from his dress and mannerisms. There is no reason to suppose that any of the specimens discussed below were not collected by Klotzsch as he acknowledges a collector in some instances where this occurs. Some material undoubtedly derived from the same specimens are given as from different localities, although it had been ascertained despite the different names they are from the same site, e.g. *Agaricus camarophyllus* is labelled both from Garscube and from Dougalston, part of the former Garscube estate. There is evidence that when Klotzsch found what he considered a common species he mounted material from different sites on the same sheet. Klotzsch also had contacts with J. Carmichael, a military man who on retirement went to live in Appin where he took up an interest in fungi supplying unusual material to both Greville and Klotzsch (Ramsbottom, 1963; Ainsworth, 1996). The latter also ventured, presumably when at Appin to Loch Laich, a branch of Loch Lhinne 1.5 miles from Port Appin. Many of the sites Klotzsch notes are the locations of often

long established estates and it can be assumed that his position at Glasgow under Hooker allowed him access to the owners and their policies. Klotzsch as many of his time was in contact with those around Charles Lyell senior, who held meetings on his Kinnordy estate which was situated north-west of Kirriemuir, of people of like interests⁶. This was the location where Robert Brown of the Royal Society of London also came, a candidate who had earlier declined the chair at Glasgow. From here Klotzsch like Brown probably took the opportunity to visit the glens of Isla, Clova and Prosen (see Watling 1986 featuring Brown's record of *Agaricus hypni* from Angus). Further afield Klotzsch, judging from his herbarium labels, went to Fort William, Dunkeld and to Aviemore, indeed many of the specimens inscribed 'Highlands' probably refer to when he was in the last locality. From the labels it can be ascertained that Klotzsch accompanied Hooker on some of his expeditions. The Fleming material expands our knowledge to include trips in 1831 to Bankhead, Inverary and Hamilton (Watling 2014). Klotzsch was certainly a very active man.

The localities which appear on Klotzsch's labels are listed below; for completeness additional localities accompanying other Klotzsch material have been included in bold.

Appin, Argyll-shire: Residence of J. Carmichael, retired military man who became interested in fungi contributing many interesting species to the Scottish mycota (Ramsbottom, 1963).

Aviemore, Inverness-shire: This must have been the base for the collections labelled 'Highlands'. Probably collected there with J. Hooker.

Bankhead: Seat near Rutherglen N.W Lanarkshire now dormitory suburb of Glasgow south of City Centre.

Blantyre, Lanarkshire: 2m. north-west of Hamilton where there is the remains of a priory.

Carmyle, Lanarkshire: Southwest Border of Monkland.

Castle Semple, Renfrewshire: Loch and estate close to Lochwinnoch.

⁶ By the time Klotzsch was collecting at Kinnordy Charles Lyell, later to be the famous Scottish geologist Sir Charles Lyell, had just been born and with his family moved to the New Forest. His father also Charles returned to take up residence again at Kinnordy in 1821; he basically disowned his eldest son for becoming a scientist and not continuing his studies in law. However, Charles senior was a botanist in his own right specializing in cryptogams and entertained many important botanists of the time. He also contributed to Sowerby & Smith's British Flora. Indeed Brown named the bryophyte genus *Lyella* after him. What better place for Klotzsch to collect than on the estate of a person devoted to cryptogamic botany.

Dougalston, Stirlingshire: House and loch, 1m. south east of Milngavie. Also Duglestone (+/-e) and Douglastone.

Erskine, Renfrewshire: 5m. north-west of Paisley, former large estate with mansion; now golf course and departure point of ferry to Old Kilpatrick.

Fort William, Argyllshire: Important hub for travellers to north-west Scotland.

Gilmour Hill: The seat of the University of Glasgow and now known as Gilmorehill.

Garscube, Dunbartonshire: A former estate 1m. west of Maryhill, with a mansion built in 1827; this was subsequently demolished because of 'dry rot' making way ultimately for the Glasgow Veterinary College. In fact many of the collecting sites of Klotzsch are now undoubtedly under buildings.

Gallowhill: Gallowgate, East Glasgow.

Glenhead, Glen Isla, Angus: Close to Kinnordy and visited there probably whilst with Charles Lyall senior.

Hamilton: 10 3/4 miles south-east of Glasgow at the junction of the Rivers Avon and Clyde, and seat of the Duke of Hamilton.

Inveraray: Argyllshire: West side of Loch Fyne and seat of the Duke of Argyll.

Kinnordy Estate, Angus: 1 1/2 m. north-west of Kirriemuir; birthplace of Sir Charles Lyell (1797-1875).

Lochlaggan South-west of Kingussie, Invernessshire: Visited probably during his visit to the Highlands.

Loch Laich, Argyll-shire: Branch of Loch Linne. 1 1/2 m. north-east of Port Appin and undoubtedly visited whilst in Appin.

Sandyford, Botanic Garden, Glasgow situated between Souchiehall Street and Argyle Street, south of Kelvingrove Park.

DISCUSSION

A number of factors have emerged during the examination of Klotzsch's material. Firstly, that he was a particularly good observer and although there are few discrepancies between his interpretation of the classical taxa and our present understanding it is evident that the majority of identifications agree with today's concepts. Because of this keen observational power one can guess why Hooker chose to employ this young man from Germany. It is probable that he had had a good reference from his mentor *viz.* Prof.H.F.Link. Klotzsch also recognized that some of his collections did not agree with any of the fungi described in the texts which were available to him. Some were proposed as new species, one being *Suillus grevillei*, common and widespread where-ever larch is grown; others which he recognized have since been given formal names by later authors. Thus his *Omphalia montosus* is *Lichenomphalia ericetorum*. Available epithets have been located for some of the new species he proposed *Agaricus tabularis* is obviously *Lacrymaria lacrymabunda* judging from the characteristic structure of the basidiospores.

However, there are a few examples where Klotzsch adopted species names in rather bizarre ways, especially *Agaricus lacrymabundus* and *Agaricus camarophyllus*. A few of Klotzsch's identifications are somewhat confusing in their modern sense, sometimes quite extraordinary and so are discussed in full below with possible interpretations of the records. New species proposed were *Ag. conicolus*, *A. montosus*, *Ag. sowerbei*, *Ag. tabularis*, *Merulius reticulatus* and *Polyporus scoticus*.

CONCLUSION

Taking all into account this collection of Klotzsch specimens is of interest as from them one can at least glean some idea of the distribution in 1830 of a selected number of species familiar to us today. From his meagre notes it is possible to get an insight as to the apparent commonness of some species at sites which, although they may have changed over the last century and a half, can still be visited today. Some sites have been inspected in the last few years by members of the newly formed Clyde and Argyll Fungus group to obtain some comparative data. Klotzsch, probably through Hooker, judging from the sites he visited, had access to the West of Scotland's gentry.

193 collections have been examined covering 137 species. Of these the majority of the collections (146) are of mushrooms and toadstools (=agarics), with 18 bracket fungi and their relatives. Also present in the collections are 4 collections of club fungi, 3 jelly fungi, 11 crust fungi and 9 cup fungi. The last are restricted to the larger forms. Sixteen of the species collected by Klotzsch are of significance in a Scottish context and some on a UK basis. These include *Lepiota clypeorarioides* Rea, *Cortinarius glaucopus* (Schaeff.) Fr. & *C. scaurus* (Fr.) Fr., *Cystoderma jasonis* var. *lilacipes* (Harmaja) I. Sarr, *Ceraceomyces crispatus* (O.F.Müll.) Rauschert, *Trametes suaveolens* (L.) Fr., *Hydnellum mirabile* (Fr.) Wienm. and *Octospora alpestris* (Sommerf.) Dennis & Itzerott. Some have been re-determined including Klotzsch's new *Ag. montosus* as *Lichenomphalia ericetorum* (L.: Fr.) Redhead *et al.*, *Byssomerulius corium* (Pers.) Parmasto, *Physiosporinus sanguinolentus* (Alb. & Schwein.) Pilát. *Hymenangium* has been confirmed to be a good well-defined genus and species, and Klotzsch's interpretation of *Cortinarius violaceocinereus* (Pers.; Fr.) Fr. is realigned, confirming that this species is still not found in Britain.

One species he found (*Irpicion pendulus*) is now thought to be extinct in the British Isles and another, if proven to be Scottish, is the only vouchered record of this northerly distributed bracket fungus *Climatocystis borealis*. The information obtained from all these collections can be now merged with that of Klotzsch's other major collections held in the Royal Botanic Gardens, Kew,

which apparently include many rust fungi (Aguirre-Hudson, pers. comm., 2014) and the recently documented collection formerly belonging to the Rev. John Fleming in the Glasgow Resources Dept. (Watling, 2014). These make a substantial nineteenth century contribution to the age when classical mycology was beginning to be put on a solid foundation by the Father of Mycology, Elias Magnus Fries. It is a shame it has not been possible to solve the identity of all the fungi Klotzsch collected such as *Agaricus ocellatus* and the 19th century Scottish interpretation of *Hyygrophorus camarophyllus* but some issues have been resolved. A full analysis of these Klotzsch specimens is to be found at

(http://www.glasgownaturalhistory.org.uk/gn26_2/klotzsch_legacy_supplement.pdf) where the entries are fully discussed attended by the appropriate references and discussion. 8 entries at the end of the account cover some problematic collections. One is a new species proposed by Klotzsch viz. *Agaricus (Dermocybe) conicolus*, *Ag. relicinus* which has now been re-determined as *Inocybe cincinnata* (Fr.) Quél., *Ag. scaber*, usually taken by modern authors as a species of *Inocybe*, is not assignable to this genus and agrees with the original diagnosis, although this is a nomen confusum. Klotzsch's *Clavaria coralloides* is not a *Clavulina*, as might be expected, but a *Clavulinopsis* and Klotzsch's *Ag. Adonis* is *Mycena sanguinolenta* (Alb. & Schw.) P. Kummer, a widespread Scottish fungus. *Ag. gibbus* $\beta\beta$ *fuliginipes* is undoubtedly what is now called *Infundibulicybe costata* (Kühn. & Romagn.) Harmaja, *Ag. lacrymabundus* is *Pholiota astragalina* (Fr.) Singer and the most contentious, *Ag. camarophyllus*, is a member of *Clitocybe* Sect. *Lyophyllum*. Unfortunately, it has been impossible to unravel what the classic authors considered *Ag. ocellatus* to be from the Klotzsch material. Similarly no conclusion can be made for neither *Thelephora miniata* nor for *Tremella intumescens*. However, *Lentinus abietinus* is *Gloeophyllum sepiarium* (Wulfen) P. Karst., *Polyporus scoticus* is *Heterobasidion annosum* (Fr.) Bref. and *Merulius reticulatus* is *Physisporinus sanguinolentus* (Alb. & Schwein) Pilát all widespread taxa in Scotland.

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